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# Agricultural Research---1946

*Wheat and vetch has been found a dependable and satisfactory silage crop in Maryland. Economical methods of harvesting have been developed.*

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## FIFTY-NINTH ANNUAL REPORT
## OF THE
## AGRICULTURAL EXPERIMENT STATION

UNIVERSITY OF MARYLAND
COLLEGE PARK, MARYLAND

1945-1946

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The Station is located on the B. & O. R. R., City and Suburban Electric Car Line and the Baltimore-Washington Boulevard, eight miles North of Washington, D. C. Telephone—Warfield Exchange.

Visitors will be welcome at all times, and will be given every opportunity to inspect the work of the Station in all its departments.

The Bulletins and Reports of the Station will be mailed free of charge to all residents of the State who request them.

ADDRESS:
AGRICULTURAL EXPERIMENT STATION
College Park, Maryland

*To the Governor of Maryland, the Board of Regents,*
*and the President of the University of Maryland:*

I transmit herewith the Fifty-Ninth Annual Report of the University of Maryland Agricultural Experiment Station, as established by Act of Congress, March 2, 1887, containing an account of research and experiments conducted during the fiscal year ending June 30, 1946, and a statement of the receipts and disbursements for the same period.

W. B. KEMP,
*Director.*

UNIVERSITY OF MARYLAND
AGRICULTURAL EXPERIMENT STATION

Volume 59 1945-46

# Agricultural Research---1946

Being

The Fifty-Ninth Annual Report

For the Fiscal Year ending June 30, 1946

*By* W. B. KEMP, *Director*

WITH the return of at least an uneasy peace in the World there is an opportunity to attempt an evaluation of agricultural research—its nature, value and the distribution of its benefits.

These benefits are enjoyed by all alike, in spite of the opinion expressed at times that they are for farmers only. When a crop or a soil peculiarity is restricted to a limited area, improved knowledge bearing upon it will be of continued exclusive benefit to a few. However, the steady advance in knowledge of other crops and other soils soon distributes like benefits to all producers and eventually to all consumers. Those who suffer are farmers of the states or agricultural areas that permit themselves to drop behind in this procession of progress.

Many results of research cannot be evaluated in dollars and cents. The production "know-how" that was put into practice during the war to feed ourselves and our allies, when farm labor and many farm supplies were restricted, was an important factor in saving us from defeat. To a fighter, a ration, however monotonous, that was capable of preventing night blindness might have been beyond price.

The insurance and security resulting from control of a disease which might wipe out his flock could mean the difference between success and bankruptcy to a broiler producer. The value of the stability which results from this insurance cannot be calculated. In spite of these intangibles, it seems worth while to attempt a financial evaluation of research in terms that are reasonable.

Let us look first at the profits to farmers.

The acreage of harvested crop land ceased its steady increase around 1909. Since that time it has fluctuated widely, reaching 311 million in 1909 and 321 million in 1939. During that period there have been four forces in operation all of which would tend to reduce agricultural production. One of these is reduction of manpower on farms. A second is depletion and erosion of farm land. A third is the introduction and spread of insect invaders. A fourth is the introduction and spread of plant and animal diseases.

Only the first of these needs further comment here. In 1910, 35 percent of our people lived on farms and 12 million were employed in agriculture. In 1945, 18 percent lived on farms and less than 10 million were employed in agriculture.

The total potential decline of agricultural production under the impact of these four forces is difficult to estimate. All will agree that it is considerable. However, the actual change has been, not a decline, but an increase of 67 percent; from an index of 79 in 1910 to 132 in 1945. During this same time the production per farm worker has more than doubled, from an index of 94 in 1910 to 191 in 1945.

The difference between a potential decrease of considerable proportions and an actual increase of the amount indicated has been made possible by the results of research. This research has been conducted over a long period of time by many people in many countries and its results have been applied here to our specific problems.

Many agencies have contributed in getting the benefits of this research to the farmers. Some benefits have been carried either by the agricultural extension services or by the agricultural press. The effects of others, in terms of abundance and quality of product, have been passed along by industries which supply farmers with fertilizer, lime, feed, seed, spray materials, machinery and other commodities. It is true that some of these industries have maintained private research programs. Others are helping to finance research programs in the agricultural experiment stations. For the group as a whole the major fundamental contributions can be credited to research in the stations supported by public funds. These contributions can be expressed in terms such as (1) plant and animal nutrition, (2) plant and animal breeding, (3) effective cultural practices, (4) the control of insects and diseases, (5) the processing of fertilizing and liming materials, (6) the development of labor-saving devices.

How can results of these practices be expressed in terms of dollars and cents to farmers?

Gross farm income in 1910 was 7 billion dollars. In 1945 the value had risen to 24 billion. However, this was not all net gain because the purchasing power of the farmer's dollar had decreased from an index of 104 to 57, when based on 1910-14 values. If gross farm income is adjusted for change in the wholesale price of farm products, the value rises from $7 billions in 1910 to $13.5 billions in 1945. In terms of a 1910-14 dollar, this change represents a total increase of $6.5 billions and an increase per farm worker of $787 per year from a total of $586 in 1910 to $1,373 in 1945. In terms of a 1945 dollar, it represents a total increase of $11.8 billions and an increase per farm worker of $1,429 per year from a total of $1,064 in 1910 to $2,493 in 1945.

What proportion of this value can be ascribed to the results of public agricultural research? Certainly, a very appreciable proportion can be so ascribed. However, the annual cost to the public for such research is less than 0.4 percent of the increase.

What has been its value to society?

One set of values to society results from the improved purchasing power of farmers for the products of industry and commerce. It can be assumed that this change is proportional to the improvement in farm income. A second set results from the processing and marketing industries that use the increased volume of farm products as their raw materials. Foods alone increase $18 billions in price while moving through these operations from farms to consumers. The contribution of other farm commodities, such as raw goods for the clothing industry, is difficult to estimate. A third set of values results from the improved variety, palatability and nutritive quality of foods. A relatively large segment of the total research program has been devoted to these ends primarily. A fourth results from the decreased relative cost of foods and other farm commodities. The entries in a farmer's record book for the year 1802 shows that at that time the income from 2¼ days of work by an artisan was required to pay for a bushel of wheat. Today about the same number of hours of an artisan's work would be required for this purpose.

The Bureau of Agricultural Economics has calculated the percentage of the consumer dollar which would have been spent for food each year from 1913 to 1945 if individual food consumption had remained constant at the rate which prevailed for the years from 1935-39. These percentages start at 29 in 1913, rise to 35 at the end of the first world war, and decline to 15, or 52 percent of the initial figure in 1945. This reduced food cost would have released another $18 billion for the purchase of industrial products were it not for the fact that food consumption increases as its relative cost decreases. Figures for actual consumption go back to 1929 only. For the five-year period beginning then 25.4 percent of the consumer dollar was spent for food. The percentage averaged 21 for the past five years.

An important reason for the increased capacity of consumers to buy the products of industry is the reduced percentage of their income that must be expended for food. This reduction in relative food costs has been brought about by increased economies in its production resulting from research.

These facts verify the statement that benefits from agricultural research are enjoyed by all of society, not by farmers only. They show also that the investment by society in this work has been a highly profitable one.

# Highlights in Progress of Research

## FACTS IN THE ECONOMIC PICTURE

### FARM ORGANIZATION AND MANAGEMENT

**Production Adjustments**—The change from wartime to peacetime brought to the front the question as to changes, if any, that should be made in the production program carried out by Maryland farmers. A study was made and the facts obtained and recommendations made were given in a report entitled "Farm Production Adjustments for 1946 in Maryland."

It was indicated that demand for most farm products would be about as good for 1946 and perhaps the first half of 1947 as at most any time during the war. The need appeared to be for greater emphasis on production of some commodities than of others. In other words, it seemed that changes would be in the substitution of enterprises, or contraction or expansion of certain enterprises, rather than in greater production in all lines.

Dairying might be expected to increase, but at a slower rate. Broiler production is at a high level and some curtailment may well result as competition with the supply of red meats increases. Shortage of feeds is still a serious problem for dairy, poultry or general livestock farmers. Therefore, some increases in production of feed grains and hay are recommended. The acreage of truck crops for fresh market and for processing is expected to remain at near present levels for a year or so, but farmers will probably specialize in fewer types of vegetables.

**Postwar Purchase and Improvement Plans**—The accumulated needs of farmers during the wartime period in the way of equipment and improvements were indicated by a survey of their plans in the immediate postwar period. This survey indicated that Maryland farmers plan to spend $72,670,000 or $1,990 per farm, for improvements in the farm plant, for household equipment and general farm services in the first two postwar years. Of this amount, about 51 percent was expected to be spent for machinery, 38 percent for buildings, 6 percent for household equipment, and 5 percent for general service improvements.

Included in the plans of farmers was intallation of electricity by about 4,600, water systems by 3,600, and sewage disposal plants by 1,000. Bathroom fixtures, washing machines, refrigerators and home freezing units account for 75 percent of the anticipated expenditures for household equipment.

Farmers were asked how they expected to finance these purchases and improvements. According to replies, 54 percent planned on doing it from current income during the two-year period, 34 percent from savings, 9 percent from loans, and 3 percent from other sources, mostly merchant and installment credit.

An idea of the accumulated need may be gained from comparison with pre-war conditions. In the Census year of 1939, farmers in Maryland spent $3,706,000 for implements and machinery and $3,203,000 for building materials. In the first two years of the postwar period, they plan to spend $36,990,000 for implements and machinery and $27,410,000 for building. The expenditures for these items in each of the first two postwar years are expected to be about five times the prewar expenditures.

**Farm Mortgage Debt**—The ups and downs of farm mortgages in two counties were studied for the purpose of constructing an index of the size of this indebtedness in the period from 1917 to January 1, 1946. Approximately 1,500 farm mortgage schedules were collected in Harford County and 500 in Frederick County.

The size of the farm mortgage debt in Frederick County appears to be falling slightly. It rose rapidly in Harford County from 1917 to 1925, when it was approximately 137 percent of the 1917 level. The size of the debt declined in the period from 1926 to 1930. In the latter year the index was 126. From 1930 the debt load rose until 1941, when the index was 158. There was a sharp decline in 1941, 1942 and 1943 to a level of 146 percent of the 1917 debt. The decline has continued slightly in 1944 and 1945, but it is still far above the level of World War I.

**Father-Son Partnership**—Interest in partnership arrangements between fathers and sons is greater in this State now than ever before, because of the shortage of year-around skilled farm hands. Apparently farmers are becoming conscious of the need for keeping on the farms many of the best young men. Father-son partnership arrangements may be one of the best means of bringing this about.

Typical case studies of father-son partnerships are being studied in different counties of the State. These agreements vary in form from a wage payment, a share in the receipts from crops and livestock, to joint ownership of the farm with a sharing of the receipts and expenditures by both parties.

It is evident from the study thus far that much confusion exists in the minds of rural leaders as to how best to approach this problem. Only a small percentage of Maryland farms have any form of partnership arrangement. None studied have written agreements. Most agreements are loosely formed. One of the difficulties is the failure of the father to gradually shift responsibility and management decisions to the son. Another difficulty is that many farms are too small to support two families.

**Economic and Social Status of Negro Families**—A study to obtain factual information about the economic and social status of rural Negro families in Maryland was inaugurated by the Department of Agricultural Economics and Farm Management of the Experiment Station, in cooperation with the General Education Board of the Rockefeller Foundation and the Negro institutions in this State.

Included in the study were areas in the five counties of Southern Maryland, seven counties on the Eastern Shore, and Montgomery County. The communities in these areas having the greatest concentration of Negro families were selected for study.

Negroes constitute 17 percent of the population of Maryland; in Southern Maryland they represent 25 percent and on the Eastern Shore 28 percent of the total population.

Data have been tabulated to show by groups of farm and non-farm families information on such items as: Tenure; size of holdings; kind, amount and value of products grown and sold; income; condition of buildings; home facilities; size and composition of family; educational attainments; and participation in community organizations, as well as rural-urban migration.

## FARM TAXATION AND FINANCE

**Farm Income Tax Records and Reports**—Ways in which the farm schedule might be changed for the better may be approached from two standpoints; First, by improving farm record keeping and coordinating it with income tax records; and, second, by more accurate returns from more farmers.

Persons assisting farmers in preparing income tax returns believe, in general, that lack of records and inability to understand the complex depreciation procedure are the major income tax reporting difficulties of farmers. Farm schedules filed for State purposes in Maryland are about evenly divided between farmers having no other major occupation or income and persons owning and, in most cases, operating farms but who have other major occupations or incomes. Most of the farm schedules showed depreciation but, to a large extent, improperly completed. Nearly all of the schedules showed expense items in addition to the list supplied. On three-fourths of the schedules the quantities of farm products sold were not listed. Reporting farm income and expenses in even dollars, often in units of $10 to $100, was a common practice, especially for the non-taxable returns.

**Postwar Revenues**—That State and local revenues in Maryland for the years immediately following the war will be adequate for normal governmental functions is indicated by a study conducted by the Experiment Station.

It was found that the bonded indebtedness of the State and of most rural counties is relatively light. Unequal assessments among counties and differences in the exemption status of properties in the various counties weakens the effectiveness of the school equalization program. There is need for a better basis for distributing public revenues for support of the major governmental services in Maryland, in order that more equitable rural public functions may be provided.

Among the problems of postwar fiscal policy which appear to be important are: Improvements in procedure, technique and policy in determining each taxpayer's share of tax responsibility; more rigid State policy in granting to local governments tax levy and exemption powers that tend to weaken, or be in contradition to, basic principles of State functional support; and, readjustments in fiscal or tax sharing relationship between the State and local governments, to the end that more equal services may be provided rural people under equality of tax burdens.

Detailed results of this study appear in Experiment Station Bulletin No. A41, '"Postwar Revenues for Public Services in Maryland."

**Classification of Farm Land for Taxation**—Failure of assessors to currently classify land for tax purposes in accordance with the actual land use classes and to properly sub-divide land use assessments according to important differences in land capability results in material errors and inequalities in farm land assessments. Land can be more equitably assessed by simple methods of determining trends in land values, crop yields and differences in land capability. Rural tax maps will help greatly in achieving that goal. Bulletin A42, "Technique for Classifying Farm Land For Tax Purposes", gives results of a study along that line.

**Forest Taxation**—Information on woodland and forest assesments was obtained from the records of three counties. The assessments on woodland are rather uniform in two of these counties, although in both counties the policy is changing to one of variations in unit rates. Average assessments per acre range from $9 to $19 in the three counties. Woodland assessments constitute 11 percent of the total tax base of one county, but only 1.3 percent of that of another county.

Facts developed in this study will show how the total tax basis would be altered by eliminating or reducing the woodland property tax and substituting a yield tax. Also, the extent of the poor practice of assessing woodland at uniform rates per acre.

## MARKETING FARM PRODUCTS

**Transportation of Milk by Motor Truck**—The need for more economical collection and transportation of milk was shown by a survey of the situation in the Baltimore milk shed.

This survey indicated that local cooling plants in Maryland received about 1,000,000 pounds of milk daily in May, 1943. Plants in the Piedmont area received about two-thirds of this volume. About 15,000 miles were traveled daily by vehicles transporting milk to the plants. Hauling 730,000 pounds of milk daily from 2,400 farms in Western Maryland to Baltimore dairies required about 12,000 miles of vehicle travel, 62 percent of which was in connection with direct hauling from farms to Baltimore. Farmers' vehicles traveled 22 percent of the 12,000 miles.

The advantages of providing a transportation system that moves milk quickly from farms to dairies, thus safeguarding the quality and condition of milk, and reduces to a minimum the duplication and over-lapping in assembling and hauling milk are evident from results of this study.

**Machinery and Farm Supplies**—Farmers bought large numbers of tractors and other heavy types of machinery during the three years prior to the entry of the United States into World War II; consequently, a large part of the heavy equipment was in good condition at the beginning of the war. The lighter and horse-drawn equipment by reason of being numerous, are important labor-saving devices. Many machines can be modified, or home-made pieces can be constructed, to reduce labor requirements on farms.

About one-half of the feed and fertilizer dealers in Maryland sell both feed and fertilizer. Feed requires more truck mileage in delivery than does fertilizer because more steps are involved in its distribution and smaller amounts are delivered to a farm on one trip.

Most dealers have established delivery routes and minimum amounts they will deliver at a call. About one-half of the dealers made no delivery charge for feed, but most dealers charged 75 cents per ton of fertilizer delivered. Two-thirds of the fertilizer was hauled to farms during 13 weeks of the spring months. Farmers did not obtain their fertilizer well in advance of use because they had inadequate storage facilities and because the fertilizer would not keep without lumping.

Detailed information on the machinery situation and transportation of farm products is given in a number of Experiment Station bulletins.

**Baltimore Market Facilities**—Farmers and merchants want to reduce the time required to market and distribute produce in Baltimore. Grocers in that city desire a centralized wholesale market, because of difficulties in buying produce in the scattered wholesale markets now prevailing, and because an equitable pricing structure would likely result from a consolidated market area.

Records were obtained on the distribution of farm produce from nearby Maryland counties after being sold at Marsh Market. Traffic counts of vehicles in the Camden Market area were made during the marketing hours, and records were made of the parking time of vehicles being unloaded and loaded in certain portions of the market.

In order to get the views of retailers in the market area, grocers in Baltimore were contacted and information was collected on where the retail grocers buy their produce, the approximate time of day they collect produce from the respective markets in Baltimore, time spent in purchasing produce, and their attitude toward the present market facilities.

This study shows the extent to which loads are split into individual sales and the amount of delivery service farmers render in disposing of their produce. Facts on the amount of time spent in unloading, buying and loading in Camden Market should aid in devising a method of handling fresh produce more quickly and efficiently. Canners take 35 percent of the volume of nearby produce sold at Marsh Market; buyers in Camden Market, 21 percent; other buyers in Baltimore, 28 percent; and out-of-town buyers, 16 percent. One-half of the loads were divided among two or more buyers, and nearly 60 percent of the loads were delivered to only one area in Baltimore. A limited number of loads had to be delivered to four or five parts of the city.

**Prices Paid by Farmers**—A sharp rise in the prices of farm products in the state during the last few years is indicated by the Maryland index of prices received by farmers. But costs have risen, also. The only real measure of the general upturn in farm costs is a State index of prices paid by farmers.

About 9,000 questionnaires were filled out and returned by farmers showing the quantities of various items bought, the amounts spent for each group of commodities, number of acres in the farms reporting, operator's tenure status, number in family, and number of work animals on the farm. Information from this survey will make it possible to determine changes in the over-all costs of wartime purchases by farmers and to relate prices paid to prices received.

## LAND ECONOMICS

**Farm Tenancy**—Landlords and tenants in Southern Maryland and in the lower Eastern Shore area were interviewed to obtain information on the division of receipts and expenses, and various types of leasing arrangements in operation.

The most important method of sharing income and expenses on the tenant-operated farms was on the half-and-half basis. On farms operated by share-croppers, income and expenses were divided on a two-thirds—one-third basis. There was almost universal opposition to written leases on the part of landlords and tenants. Many comments by both landlords and tenants show a lack of understanding of the legal aspects of their contractual relationship.

**Farm Real Estate Market**—Farm real estate values in Maryland have risen 70 percent above the 1935-39 average, are still increasing, and for March 1946 were just about the 1920 level.

In the upper Eastern Shore area, farm real estate values in 1945 were only about 26 percent above the 1935-39 level. A partial explanation of this low index value lies in the fact that in 1936 and 1937 about 63 percent and 57 percent, respectively, of all transfers were to non-farm buyers. The vast majority of these transfers were of water-front properties, where water-front values were the consideration rather than inherent agricultural worth. In Southern Maryland, where tobacco has been bringing high prices, farm real estate values have increased about 100 percent. Likewise, greater increases have occurred in real estate values on the periphery of Washington, D. C., and Baltimore than in the more strictly rural areas far removed from the large cities.

## AGRICULTURAL ENGINEERING

**Curing and Storing Sweet Potatoes**—Further information was obtained on the effect of pre-storage history on the keeping quality of sweet potatoes.

Little difference in shrinkage was noted between potatoes picked up immediately after digging, potatoes picked up after an hour or more in the sun, potatoes which were soaked immediately before being placed in storage, and potatoes which were left out in the field one night between digging and storage, when such potatoes were cured and stored under like conditions. Shrinkage or loss in weight is not a good indication of keeping quality when potatoes are stored under the same temperatures and humidity conditions. Slightly greater differences, but not outstanding, were noted in the percentage of rot losses.

Some rather interesting results of curing and storage temperatures were obtained from six compartments of the Station sweet potato curing house, each holding 12 bushels.

Orange Little Stem potatoes cured at 85° F. and stored at 45° F. were a complete loss, while potatoes cured at 85° F. and stored at 50° to 55° F. showed only 7 per cent loss due to rot. When potatoes were cured at 75° F., and stored at 45°, 50° and 55° F., the losses due to rot were 38, 22 and 2 percent, respectively.

**Grain Storage on the Farm**—In several tests of the small experimental grain dryer of 1 square foot cross section, corn was dried from 22.3 percent moisture to 20 percent at 5.3 bushels per hour, and from 22.1 percent to 17.9 percent at 2 bushels per hour.

The coils used were not as effective as they should be, due to lack of proper manufacturing facilities and lack of high conductivity materials. Gross efficiency ranged from 47.7 percent to 38.2 percent, and net efficiency, neglecting the loss in the heater itself, from 68.3 percent to 58.8 percent, indicating that the high efficiency of this drier is maintained in drying corn.

The large, portable drier was moved to Hutchison, Kansas, by the U. S. Department of Agriculture for sorghum drying tests. Number 2 yellow milo was dried from 13.61 percent to 10.75 percent at 36 bushels per hour and from 13.18 percent to 12.22 percent at 64 bushels per hour. Maximum temperature at the drier was 152° F.

## FARM CROPS

**Corn Hybrids**—Although the acreage planted to hybrids will continue to expand without further improvement in varieties, the search for better hybrids continues and also efforts to select hybrids better adapted to local needs.

More than 100 double crosses, the kind of hybrids that are of most direct interest to farmers, were included in one or more of eight regional tests. The year provided comparative results for a wet season. Also, the activity of the European corn borer and the presence of stalk rots, together with wind storms late in the season, permitted good observation on stalk strength.

The mean percentage for below-the-ear stalk breakage varied from 12 to 60 percent in the several tests. U. S. 13, a hybrid used widely in the State, had a good comparative record for stalk strength. On the other hand, Illinois 448, commonly used for silage and late grain production, was disappointing. As a result of its poor showing for stalk strength, it probably will be replaced by experimental hybrids now in test. All data for the double cross tests are reported in Miscellaneous Publication No. 43.

Similar, but less extensive work was conducted with sweet corn. In addition to the study of local inbred lines in the nursery, a yield test including 72 entries was conducted at College Park.

Several experimental Country Gentleman hybrids from the Indiana Station gave promise. For the second year, the Hybrid Golden Hulless xH was outstanding for tenderness of pericarp and kernel flavor. Data collected to date appear to justify the use of this medium early, yellow hybrid as a high quality, medium productive corn especially suitable for home gardens.

**Small Grains**—Wheat, barley and winter oat tests were conducted annually at College Park and Ridgely.

The 3-year average yields in bushels per acre for recommended varieties of wheat at College Park are: Thorne, 28.2; Leapland, 27.2; Nittany, 26.0; Mammoth Red, 25.7. At Ridgely, they are: Thorne, 35.7; Mammoth Red, 31.9; Leapland, 31.3; Nittany, 29.5. Not only has Thorne been slightly more productive than the other varieties, but it also has been outstanding for straw strength. Its chief handicap has been low weight per bushel, especially when scab is severe.

Wong continues to be the outstanding winter barley variety at both locations. The popularity of Wong among Maryland farmers is justified by comparative test performance.

Under the favorable conditions of 1945, oat yields of 80 bushels per acre were obtained at Ridgely. At both locations, Lee and Fulwin continued to be among the top-yielding varieties.

**Short Rotations**—Lespedeza in the stubble continued to add more than 6 bushels to the wheat crop on continuous small grain plots. Wheat straw remaining on the land shows beneficial effect in the succeeding crop after wet summers and a detrimental effect after dry summers. Corn stover turned under for the next corn crop held up corn yields as much as 7.9 bushels per acre with high benefit after wet weather and low benefit after dry weather.

In a two-part dairy rotation, corn silage, barley grain and lespedeza hay produced 4,305 pounds of total digestible nutrients per acre; corn grain, wheat grain and lespedeza hay produced 3,777 pounds of digestible nutrients per acre. A balanced acreage between the two appears capable of supplying all needs for grain, silage, hay and bedding.

**Fertilizing the Corn Crop**—The checker board fertilizer experiment started in the dry year of 1944 was repeated, on both a heavy and a light soil. The wet season of 1945 gave results at variance with those of the preceding year. On the heavy, rather fertile soil, plowing under 700 pounds per acre of 7-7-7 fertilizer, or 150 pounds per acre of ammonium nitrate, did not affect yields appreciably. On this soil, 200 pounds per acre of 3-12-6 with the planter was the treatment that gave the greatest benefit. On the low fertility, sandy soil, both plow-under treatments and the planter application were highly beneficial. When plow-under and planter treatments were combined, results were additive.

## LIVESTOCK — BREEDING AND FEEDING

**New Strain of Hogs**—Work is continuing, in cooperation with the U. S. Department of Agriculture, in developing a strain of hogs from crosses of the Landrace and Berkshire. The objective is to combine the black color of the Berkshire with the confirmation of the Landrace into a strain that will be efficient in producing high quality hogs.

To achieve this objective, animals with approximately 5/8 of their inheritance from Landrace and 3/8 from Berkshire are being intermated so as to result in a strain with increasing degrees of inbreeding. The breeding program followed has resulted in a reasonably uniform type of hog of the desired color, but additional work will be required to improve various other characteristics.

**Influence of Energy Intake on Performance of Breeding Ewes.** The first of three trials in testing the effect of energy intake on breeding ewes has been completed. Three groups of ewes were fed the same rations, but at energy levels of 70, 90, and 110 per cent, respectively, of the Morrison standards for pregnant and lactating ewes. All groups of ewes were forced to take adequate exercise throughout the duration of the trial.

Results of the first trial favor the high energy level intake on the basis of condition of ewes and growth rate of lambs produced in this group. Carry-over effects of the rations will be measured by continuing the ewes in their respective groups throughout the three individual trials.

A study of blood sugar levels is being made to determine the effect of energy intake on the amount of blood sugar at various stages of gestation and lactation.

**Value of Different Hays in Winter Rations of Pregnant Beef Cows**—Barley and wheat hays were compared with mixed clover-light timothy hay in the winter rations of breeding beef cows in the first of several trials of the effects of different kinds of hay. There was a small average loss in weight of cows in each group with the smallest loss being shown with those fed clover-light timothy hay in their ration. All calves dropped made satisfactory gains. The calves produced by cows fed clover-light timothy hay made the highest average gain. Carry-over effects of the various rations will be measured in subsequent trials.

## CONTROL OF DISEASES OF CROPS

The search for varieties and strains of crops that are more resistant to damage by diseases than those commonly grown was continued with some of the crops that suffer most severely.

**Sweet Potato Diseases**—In tests of fungicides for control of field diseases of sweet potatoes, Puratized N5E, when used as a sprout dip, gave promising control of Fusarium wilt. Several materials increased sprout production and gave commercial control of seed bed diseases. Field tests were confirmed by laboratory experiments and it was found that certain fungicides stimulated cell prolification and rooting.

Fungicides in combination with a vegetable wax gave better control of storage diseases of sweet potatoes than wax alone. No treatments, however, were outstandingly valuable in control of storage diseases. An apparently new storage disease was found during the course of this work and a bacterium capable of reproducing symptoms of the disease was isolated.

**Strawberry Diseases**—More than 5,000 strawberry seedlings were grown from several crosses. The parents of these crosses were from U. S. Department of Agriculture selections which had been tested in our experimental plots and proved to be desirable under Maryland conditions. Many of these seedlings were first selected for red stele resistance and the second selection was made on the basis of fruit quality, fruit quantity, date of maturity, and other characters which would widen the commercial market from that covered by the variety Temple. Only 100 of the original seedlings were kept for further observation.

**Tomato Diseases**—Seven fungicides were applied with a conventional sprayer. Two of these were applied also with an experimental low volume air atomizer and one as an aerosol. Six dust mixtures containing Tribasic copper sulfate were applied with an experimental high velocity duster.

Zerlate, (zinc dimethyldithiocarbamate) was outstanding in the control of anthracnose.

All applications containing as much as 8 pounds per acre of Tribasic copper as well as Dithane-zinc-lime gave good control of fruit rots and defoliation diseases.

**White Potato Diseases**—Attempts to better the current method of breaking dormancy, in order to assure a two-crop season, were continued. The results were inconclusive, but Thiourea appeared to be the best treatment. Addition of fungicides to such treatments, to prevent subsequent rots, retarded growth, even though the diseases were controlled.

Other new varieties were tested for disease resistance under Maryland conditions and seedling 47147 is under consideration for introduction as the variety "Marygold". Menominee yielded well under our conditions and should be valuable for scab-infested soils. Pontiac appears to be a good variety for Maryland growers to use in production of certified seed for Florida growers.

## DAIRYING AND DAIRY PRODUCTS

**Rancid Flavor of Milk**—Because of the economic importance of the rancid flavor of milk, attention has been given to means of measuring, controlling, or preventing its presence. Under suitable conditions, all raw milk or raw milk products will develop this obnoxious flavor. It results from the splitting of milk fat by the action of certain enzyme (s), and is the major chemically-produced off-flavor of raw milk.

Experiments have shown that the development of rancidity in raw cream butter may be greatly retarded, or perhaps entirely prevented, by the addition to the cream before churning of a commercial cereal extract. Addition to the cream of .75 percent by weight of the extract prevented fat splitting in butter held for three weeks, whereas the untreated raw cream butter underwent considerable lipolysis accompanied by rancid flavor development.

**Milk Secretion**—While some of the milk fat is formed from fat in the feed which passes into the blood stream and thence into the milk, it has been found that approximately one-third of the milk fat is formed from some other substance. By feeding cows intravenously, it has been shown that this substance is not blood sugar or blood protein. Other substances will be fed by this method until the substance or substances have been ascertained.

**Ketosis**—This condition, which is quite prevalent in Maryland herds, is called "ketosis" because certain acid-like products known as ketones are produced in excess amounts and accumulate in the blood and urine. It usually occurs in cows within a few days to a few weeks after freshening. The cows go off feed, become lethargic, lose weight rapidly, and may have difficulty in maintaining their equilibrium when walking. The more severe cases may be highly excitable.

The condition was produced experimentally by allowing fresh cows to have only half as much feed as they required. Ketosis developed within two to three weeks. When withholding of feed from the cows was begun from a week to 10 days before calving, the condition developed within a week to two weeks after calving.

These results show that the condition is due, primarily, to a depletion of the carbohydrate reserves of the body. The increase in ketone bodies in the blood and urine is only secondary and is caused by the carbohydrate deficiency. The condition can best be prevented by feeding cows more heavily, before and after calving.

These studies have shown also that a vitamin A deficiency in dairy cows does not produce ketosis, a significant finding in view of the many reports published recently claiming that Ketosis is caused by a vitamin A deficiency.

**Di-Ammonium Phosphate**—Feeding trials demonstrated that di-ammonium phosphate is sufficiently palatable and non-toxic to be used as a protein supplement for ruminants at a level of 1 percent in the ration. At this level it furnishes the equivalent of 1.31 percent protein and .23 percent phosphorus. When rations containing 1 percent of di-ammonium phosphate are fed to ruminants, additional supplemental phosphorus need not be added.

**Vitamin A Requirements of Calves**—The spinal fluid pressure of calves remains as the most sensitive technique for detecting a border-line vitamin A deficiency. It was shown that the disturbance of ascorbic acid synthesis in the vitamin A deficient calf plays no part in the mechanism of the increased spinal fluid pressure in calves.

## CONTROL OF INSECT PESTS

**Concentrated Sprays**—Results of three years' work indicate that the aerosol method of spray application has a definite place in the control of aphids on peas; necessary equipment is light and easily transported; the insecticide is applied rapidly; and the effectiveness of treatment is not influenced greatly by the weather conditions, excellent results being obtained in winds up to 25 miles per hour and preceding or during light rains.

Three seasons' work has been completed on the liquefied gas aerosol method of applying DDT for control of field crop insects. Considerable effort was devoted to pea aphid control during the three years. In the first year's work with small, hand-drawn aerosol dispensers the aerosol method of application proved to be highly effective against the pea aphid and other pests of field crops. The field aerosols appeared to be practical and worthy of further investigation. In 1945, equipment of sufficient size for effecting commercial scale treatments was constructed and used in experiments planned primarily to determine dosage and speed of application. This work served as a basis for commercial operations that were carried out in 1946. The project was carried out cooperatively by the departments of Entomology and Agricultural Engineering of the University of Maryland and the Bureau of Entomology and Plant Quarantine.

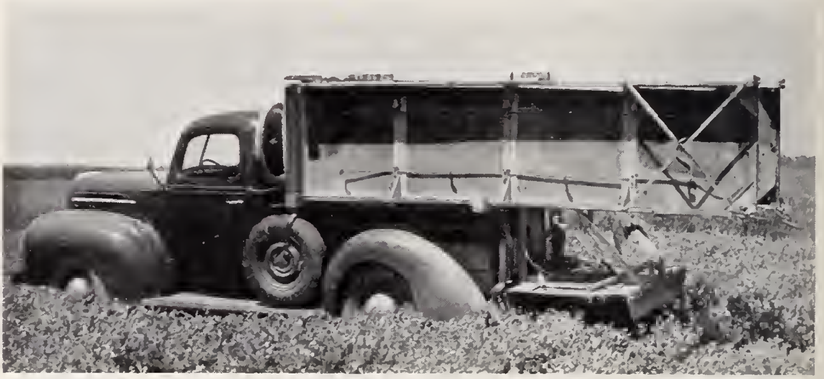

FIG. 1. *When traveling from field to field, the wings are carried in a rack on the side of the truck. Four hundred pounds of insecticide, enough for 40 acres, is carried on the truck at a single loading.*

Most of the 1946 work was done in cooperation with Saulsbury Brothers of Ridgely, Maryland. A 30-foot dispenser was constructed and mounted on a small pick-up truck and used in conjunction with the 24-foot truck-carried dispenser which had been constructed in 1945 by the Experiment Station.

Results of this commercial operation were quite satisfactory. The compounding of liquefied gas aerosol solution proved to be comparatively simple and rapid; as much as two tons were put up in a single day by two experienced men. The dispensers performed well in the field. There was but little nozzle stoppage; usually no more than two or three a day needed cleaning; in one day 120 acres were treated with no stoppage of nozzles. The entire Saulsbury planting of 700 acres was treated in one week, 400 acres of which was done by the two machines in two days.

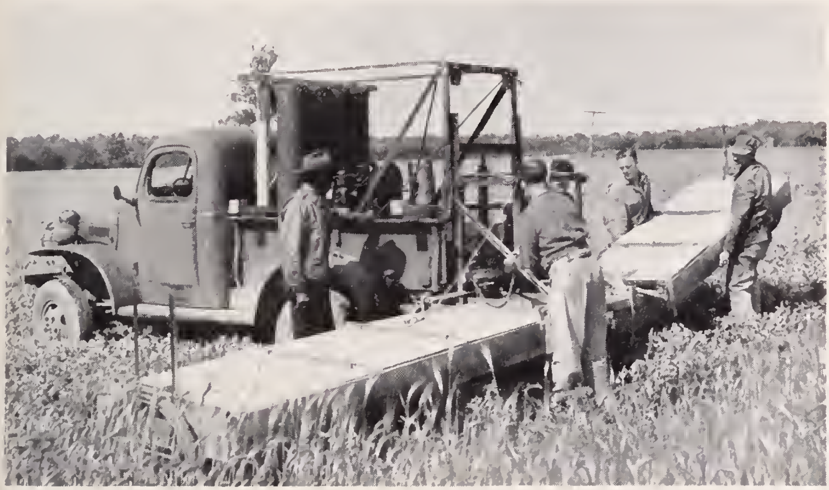

FIG. 2 *The wings are demountable and are light enough to be handled by two men. It requires about 5 minutes to assemble the machine for use.*

The results obtained with DDT aerosols compared favorably with those secured with DDT dusts, but were slightly inferior to DDT emulsion sprays. Small plot samples taken from treated and untreated portions of fields in Talbot and Caroline counties showed up to 79 percent increase in yields and the entire Saulsbury planting yielded slightly over 2,700 pounds of shelled peas per 5 bushels of seed planted. This is the highest yield these growers had secured in recent years over their entire acreage. It should be pointed out in evaluating these results that 1946 was a very favorable pea year from the standpoint of weather, though the aphid infestation was severe over most of the acreage.

The cost of materials for this commercial operation, not including labor, was approximately $2.25 per acre.

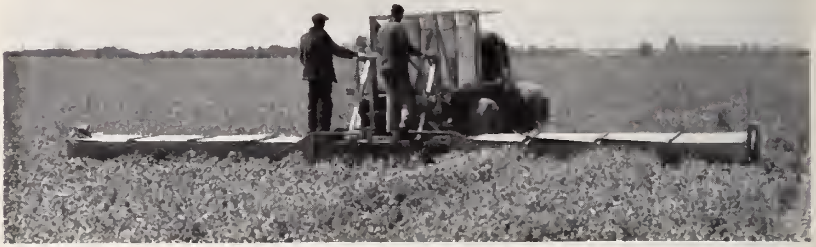

FIG. 3. *A commercial sized dispenser designed for broadcast peas. This machine is capable of treating 100 to 120 acres per day at a speed of 5 to 7 miles per hour. Two such machines have been constructed for experimental work.*

**European Corn Borer**—A method was developed for eliminating particles or entire corn borers from whole grain corn by use of a salt solution in connection with a flotation washer. This scheme utilizes the difference in specific gravity of the worms and the salt solution, permitting the floating off of all particles as the corn is pumped from the sump of the washer.

**Control of Poultry Ectoparasites by DDT**—There is no danger to the birds in any ordinary use of DDT for ectoparasites of poultry. This was shown by tests of the lethal and toxic effect on poultry of known doses of DDT administered in capsule and in mash over various periods, and the effect of the ingestion of flies killed by DDT. Lice can be controlled by two dustings of 20 percent DDT in pyrophyllite.

**Japanese Beetle**—Baits have been developed that can be purchased at reasonable cost and that will attract more beetles than the old standard baits. Due to the increase in cost of the standard bait from aproximately 30 cents a pound to $10 a pound, the new baits have an immediate practical value. The results were published in the Journal of Economic Entomology, April 1946.

**Migratory Beekeeping**—Movement of bees from the central area to the mountain areas in early season and to the Eastern Shore in late season were both productive of large increases in honey production. These results point the way to stabilization of honey production in Maryland on a much higher and more profitable level.

## FRUITS AND VEGETABLES

**Nutritive Value of Canned Foods**—The portions of the various nutrients in canned foods that are leached into the surrounding liquid vary from none to one-third of all the nutrients in the can, depending on the solubility of the nutrients and the proportion of liquids to solids in the canned product. In general, at least two-thirds of all nutrient components were in the solid portion.

These facts were obtained from analyses of thousands of samples of canned foods.

Efforts were made also to find out the effect of time, temperature and type of blanching on the losses of nutrients from the raw product before processing. Steam blanching caused little if any nutrient losses, while losses increased with increased time and temperature of water blanching, ranging from none to 12 percent of the respective proximate or mineral components of the various canned foods. The calcium content of peas increased upon blanching, indicating that the peas took up calcium from the blanching water.

**Nutritive Value of Canned and Dehydrated Sweet Potatoes**—The most nutritious canned and dehydrated sweet potatoes resulted from raw stock that had been cured and stored for a minimum of three weeks. There was little effect on the nutritive value during the canning process, but dehydration reduced ascorbic acid content to about one-tenth and carotene content to about one-half of the original values. Heating the canned product in preparation for table use had little effect on nutritive value. When compared on a dry weight basis, neither the length of the rehydration period, nor the amount of water used for rehydration had an appreciable effect on the nutritive value of the dehydrated product.

**Relation of Maturity to Yield and Quality of Vegetables**—Variations in maturity at time of harvest may cause differences in yield of peas, corn and lima beans that may be far greater than differences due to varieties, or such treatments as fertilizer applications, or spacing. Since maturity is frequently overlooked when yields are compared, it is recommended that particularly for such products as are harvested in an immature stage of development yield data be accompanied by some reliable index of maturity, such as a tenderometer value for peas or lima beans, and a succulometer value for sweet corn.

It has been generally assumed that any delay in date of harvest will result in higher yields and lower quality of peas, lima beans, or sweet corn. Tests have demonstrated that for some varieties yields level off, and occasionally even decrease when the product is still immature enough to be relatively high quality.

**Methods for Measuring Quality of Raw and Canned Fruits and Vegetables**—Maturity of canned whole corn, of raw corn in the field, or anywhere during the canning procedure can be measured by an instrument that has been devised. It was given the name "Succulometer" (Figure 4). In accuracy it is equal to the moisture test on the raw product, or the Alcohol Insoluble Solids test on the canned product, but it is much more rapid and simpler to operate than the other methods used previously. Essentially, the instrument is a hydraulic press, where the juice from a sample of corn may be extracted under controlled conditions of time and pressure. The greater the volume of juice, the younger is the corn.

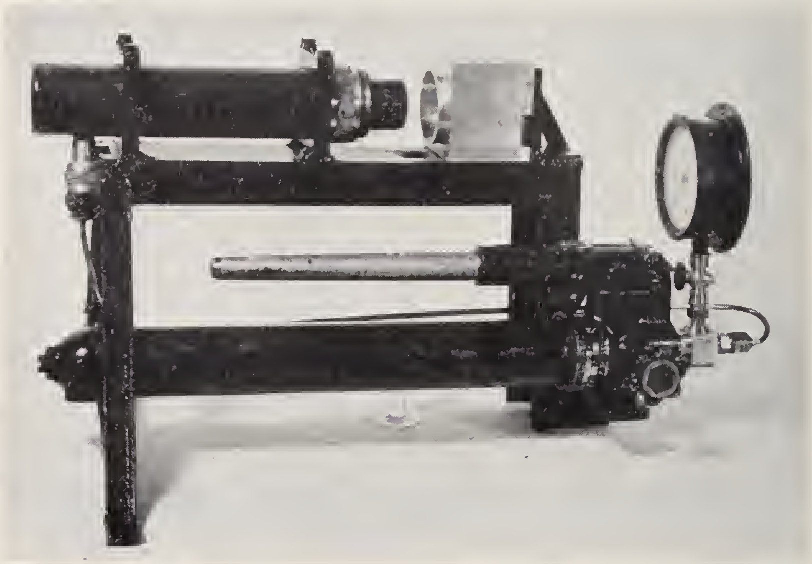

FIG. 4. *The "Succulometer", an instrument devised to measure the maturity of sweet corn by volume of the expressed liquid.*

Tentative methods for measuring color as a factor of quality have been developed for beans, lima beans, beets, carrots, corn, peas, peaches and tomatoes. The methods are based on measurements made on relatively involved and costly laboratory instruments. Work is under way to develop a simplified instrument that will be inexpensive and simple to operate. This work is in cooperation with and supported by the National Canners Association.

**Handling Sweet Corn for Best Frozen Product**—Golden Cross Bantam was selected as the variety for blanching studies. Blanching for 3, 5, and 7 minutes in hot water at 212° F. while on the cob was compared with steam blanching at 214° F. for similar periods. Following blanching the kernels were cut from the cob, sealed in moisture-vapor proof packages, placed in a -25° F. room overnight, and subsequently stored at 0° F.

In a second series of tests, the corn was cut from the cob prior to blanching. A hot water blanch for 1½, 3, and 6 minute periods was compared with a steam blanch for 2, 4, and 6 minute periods. Packaging and freezing followed, as for the first lot.

After approximately three months of storage, all lots were removed and cooked under uniform methods and the product was rated by four competent judges. It was found that for freezing better color and flavor could be obtained when corn is blanched after it is cut from the cob. Superior color and flavor resulted also from steam blanching as compared with a hot water blanch. There were no significant differences between the lengths of blanching periods used.

**Spacing of Vegetable Soybeans**—Where rows were placed 2, 2½ and 3 feet apart, with plants 4 inches apart in the row, highest yields were obtained from 3 feet spacing. In a second test having all rows 2½ feet apart, with plants 2, 3, and 4 inches apart in the rows, the 2 inch distance gave highest yields. The Emperor variety was used in these tests.

**Sweet Corn Varieties and Strains**—Yield per acre, percent of husk, trimming loss, percent of cut-off, and days from planting to harvest were obtained for 26 promising sweet corn varieties. They were planted by R. G. Rothgeb of the Agronomy Department and were harvested at the same stage of maturity for the different varieties. The results are too voluminous to be given here, but are available for those who may desire them.

When frozen samples were cooked uniformly and judged by five competent judges, it was the unanimous opinion that the yellow varieties excelled the white varieties in quality.

**Packaging of Vegetables**—The freshly harvested quality of sweet corn, as measured by sugar content and taste, can be maintained to a high degree for as long as 10 days. This was done by husking, trimming, pre-cooling the ears in iced water within a few hours after harvest and subsequently storing in cardboard containers holding six ears each at 35°F.

Studies with Clark's Bush Lima beans showed that beans harvested mechanically and shelled with a viner could be held in very acceptable edible condition for an 8-day period when stored at 32° F. Increase in the storage temperature to 35° or 38° F., greatly decreased the storage life of the shelled beans.

These facts were obtained in studies designed to find out what causes the deterioration in fresh vegetables during the interval between harvest and consumer use, and to devise methods to reduce such deterioration to a minimum.

Analysis of the gases occuring in the package showed lower oxygen and higher carbon dioxide concentration. Different vegetables, however, varied greatly in their response to an altered gas content of the packages.

**Boron Fertilization of Sweet Potatoes**—No relationship between boron nutrition of the sweet potato plant and cracking of the roots was shown in field tests on the Eastern Shore in 1944 or in 1945 at the University Research Farm, and culture tests in the greenhouse. Some cracking occurred in both tests, but it could not be correlated with the fertilization.

Varying levels of potash and lime application were included in all the tests to find out the effect of these factors upon the boron nutrition of the plant. Liming at the rate of 1,500 pounds per acre increased the soluble boron in the soil and the resulting uptake of boron by the plant. High potash applications, such as are used normally in sweet potato production, depressed the concentration of boron in the plant.

**Freezing Preservation of Peaches**—The relative merits of 16 peach varieties for freezing preservation were tested to provide much needed information for growers and processors. Among these varieties, Newday, Pacemaker, and Summercrest were outstanding in quality after freezing. Golden Jubilee, Halehaven, Early Elberta, and Redskin were rated good to excellent on the basis of color, texture and flavor. (Redskin is a new variety introduced recently by the Maryland Station). Triogem, Goldeneast, Shippers Late and Rio Oso Gem were on the borderline of acceptance, considering that high quality in the frozen product is demanded by the consumer. Sunhigh had good flavor, but turned brown rapidly after thawing. Elberta and Afterglow were definitely not acceptable for dessert purposes. Such varieties may be useful for pie stock in the frozen form.

**Freezing Preservation of Strawberries** — Good or excellent quality of a variety of strawberries as a fresh product gives no assurance that it will be of equally good quality after it is frozen.

Of nine varieties supplied through cooperation of the U. S. Department of Agriculture, Midland was outstanding as a frozen product, preferably in the sliced form. Tennessee Shipper and Tennessee Beauty were also of high quality when frozen, except that the latter was poor as a whole berry. Blakemore was standard of good quality. Bristol, Red Star, and Fairpeake were barely acceptable and would not be recommended for freezing if better varieties were available. Chesapeake made an acceptable product as a whole berry, but was not good as a sliced berry, largely due to its light flesh color. Other varieties that show light flesh color did not make an acceptable frozen product in the sliced form.

**Planting Apple Trees on Terraces**—Planting orchards on terraced lands has posed the problem of the most desirable location of the tree in relation to the berm and the channel. Gallia Beauty apple trees, planted in four positions on the terrace, have been studied during seven years.

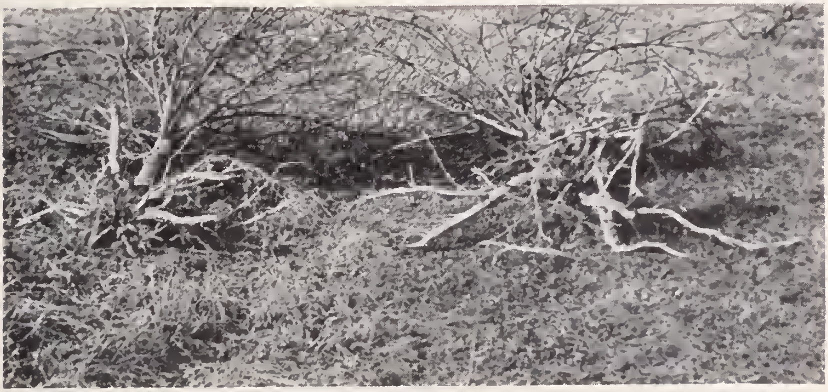

FIG. 5. *Root systems of two six-year-old apple trees showing the effect of planting position in a terraced orchard. At left is the poor root system resulting from planting just above the channel, where top soil is thin and moisture supply may be either too high or too low. At right is a good root system of a tree planted just below the berm of the terrace.*

Trees planted on the berm or on the slope below or above the berm made the best growth as measured by trunk circumference; trees planted above the channel made distinctly poorer growth. Root development, as shown by removal of trees, showed that the trees on the slope below the berm had uniformly superior root systems (Figure 5). An explanation for the poorer growth of trees above the channel was found in their root development. Some of these trees had poor root development on the side next to the channel, caused, presumably, by excessive moisture at some time during the year; some of the trees had poor root development on the side away from the channel, indicating that the lack of top-soil and moisture above the channel might also be responsible. Some of the trees planted on the upper slope of the berm showed a root development affected adversely by the moisture conditions prevailing on the channel side.

It would be expected that these trees will show more adverse effects in later years..

**Growing Peach Trees in Sod**—Cultivation of bearing peach orchards in Maryland has been reduced to a trashy type of culture which has markedly reduced soil losses. More complete conservation of the soil in peach orchards is only possible through the use of sod culture. It appears possible to make use of a sod-mulch system for a peach orchard if particular attention is given to the use of mulch, the addition of some manure to the mulch during the first two years, the application of additional nitrogenous fertilizer, and the use of poison bait to control mouse damage. On orchard sites where areas have steep slopes subject to soil erosion under cultivation, it appears that sod culture could be used to advantage.

A peach planting at the Plant Research Farm in its second season was put under sod conditions of culture in 1940. In ad-

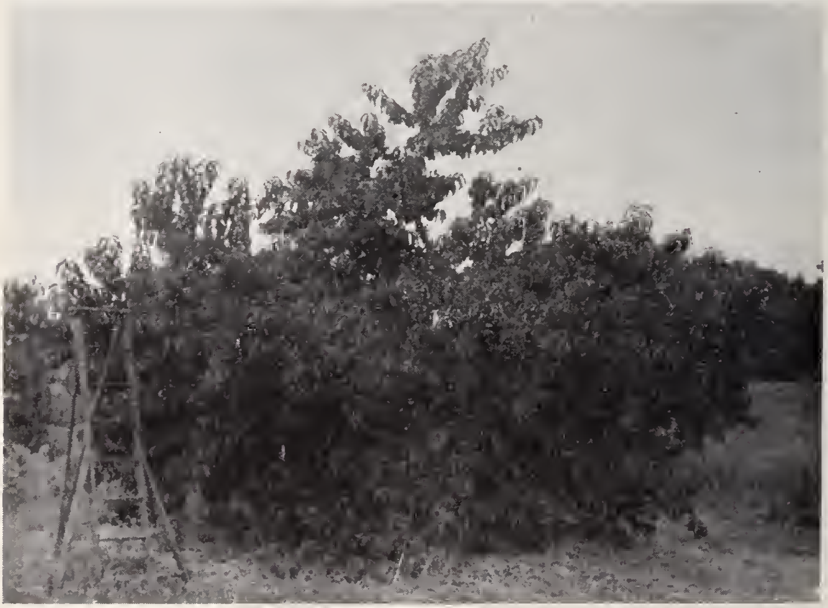

FIG. 6. *Showing excellent growth of a Vedette peach tree grown for six years under a sod-mulch system of culture.*

dition, the application of mulch material, largely rye straw, was placed under the spread of each tree and a small amount of stable manure was placed with the mulch. Several sod covers were used, including alfalfa, weeping love grass, Brage orchard grass, Victoria ryegrass, and red fescue All of the plots had a good stand of cover during the years since 1940, with the exception of Victoria ryegrass, which was crowded out by weeds and other grasses after the third season.

A decided depression of tree growth occurred during the first three years of sod culture and the trees were not equal in size to trees grown under cultivation. During the succeeding years, when the mulch decayed and soil fertility improved, the trees made excellent growth and reached full bearing size capable of producing 5 to 6 bushels per tree. In 1944 and 1946, the fruit on these trees (25 varieties) had excellent size and quality, comparing favorably with fruit grown under cultivation (Figure 6). Frost eliminated the crop in 1945. Additional evidence of the building of fertility level under sod mulch has been found in the excellent growth of replanted trees where varieties had been removed (Figure 7).

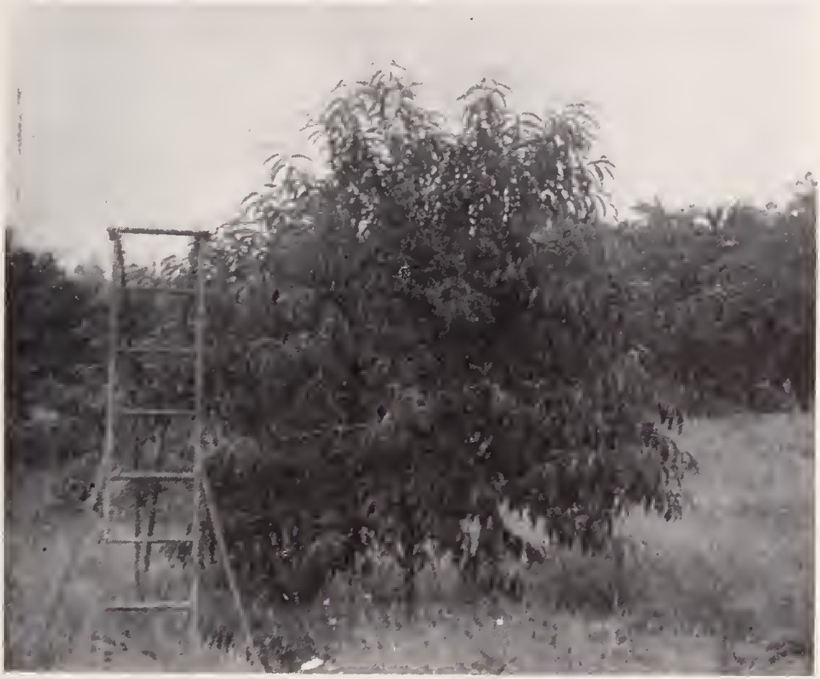

FIG. 7. *A peach replant in a sod mulch orchard, showing the excellent growth of tree in two seasons after planting.*

## NEW LIGHT ON POULTRY PROBLEMS

**Rate of Growth in Progeny to Ten Weeks in Relation to Shank Length of Parents**—Rate of growth in chickens is influenced by shank length of parents. From the Maryland Experiment Station flock of New Hampshires, two strains differing significantly in shank length at 10 weeks of age were developed by original selection and progeny testing of parents differing in adult shank length. It has been demonstrated also that in Plymouth Rocks at 10 weeks of age there is a high positive correlation between body weight and shank length. In both these breeds variability in body weight was found to be from less than 2 to more than 3 times the variability in shank length at 10 weeks of age. Variability in rate of growth was found to be relatively greatest at 4 weeks of age in females and at 4 to 6 weeks of age in males. Since the two strains of New Hampshires differed significantly in body weight at 4 weeks of age, it seems probable that the most effective selection of birds for breeding purposes to effect differences in growth rates of progeny would be on the basis of shank length and body weight at approximately 4 weeks of age.

**Body Weight and Dressed Appearance of Chickens Affected by Certain Drugs**—The rate of growth and deposition of fat in chickens, as well as the development of various organs, is influenced by the feeding of certain drugs having a hormone effect.

A drug called thiouracil tends to suppress the activity of the thyroid gland and thus the growing chicken tends to fatten. Feeding desiccated thyroid, on the other hand, stimulates the thyroid gland. Other drugs, such as some of the stilbestrols, have a fattening and tenderizing effect on the flesh of old birds and tend to increase the accumulation of fat in the tissue of growing chickens.

Feeding thiouracil at the 0.1 percent and 0.2 percent levels in the mash during the growing period depressed growth, the 0.2 percent level more than the 0.1 percent. Thyroid enlargement was relatively greater in the females than in the males, indicating a sex difference. Although the testes in the thiouracil and diethylstilbestrol lots varies a great deal, the testes tended to be smaller in these lots, particularly in the diethylstilbestrol birds, than in the controls. Combs were small and pale for both sexes in the thiouracil and diethylstilbestrol lots, whereas the combs in the desiccated thyroid lot were a bright red. On the basis of dressing and fleshing appearance, the lot of birds fed diethylstilbestrol for a three-week period at a level of approximately 30 mg. per day gave the best dressed appearance of any of the lots. Early limited feeding followed by full feeding for the last three weeks seemed to improve the dressed appearance of the carcasses. Dimethyl ether of diethylstilbestrol fed for a two-week period at the level of 50mg. per pound of feed did not appear to improve finish, affect appetite, or improve the weight of the birds over the controls under our conditions. Combs and wattles of both males and females became pale and shrivelled in the treated lots. Tasting tests indicated that the diethylstilbestrol and dimethyl ether of diethylstilbestrol-fed lots, particularly the females, were more highly flavored than the controls, although much individual variation in taste was evident.

**Heritable Differences in Shank Length of Breeding Stock in Chickens Affect Economic Qualities of Progeny**—Differences in feed utilization, growth, and body feathering have been determined between the progeny of long-shanked and short-shanked New Hampshires. Feed utilization on the basis of broiler growth was better in chickens from the long-shanked than from the short-shanked strain, due largely to the more rapid growth of the long-shanked strain of chickens. Eggs laid by the long-shanked hens were larger, on the average, than those laid by the short-shanked hens. Feed utilization per dozen eggs, however, has had a tendency to be better in the short-shanked than in the long-shanked hens because the short-shanked hens laid better, on the average.

Feather studies have indicated that ten-day tail feathering may be negatively correlated with body size. A very low percentage of the long-shanked chickens showed ten-day tail feather development; whereas, a fairly high percentage of the chicks in the short-shanked chickens showed ten-day tail feathering.

Inheritance of the shank length characteristic appears to be affected by multiple genes with a cumulative effect. After three years of selection on a family basis and mildly inbreeding the third year, the strains still appear to be quite variable in shank length. The birds, however, are much more variable in body weight than in shank length.

**Effect of Barring Gene on Hatchability, Feathering and Growth**—One pen each, 50 females to the pen, of barred and non-barred females that were full and half sisters were mated to New Hampshire males that were full brothers; then, later to Barred Plymouth Rock males of a strain different from that of the females. In addition, two pens, 18 females to each pen, of full sister New Hampshires were established. Pen 1 was mated to a male homozygous for barring and Pen 2 was mated to a male heterozygous for barring. Two weeks after first hatch, the males were switched; that is, the male homozygous for barring was mated to females in Pen 2, and male heterozygous for barring transferred to Pen 1. These two male birds were full brothers and weighed approximately the same.

Egg production in the barred and non-barred females and progeny growth and feed utilization from those two pens were approximately equal. Hatchability of the dams and feathering of the progeny appear to be somewhat better in the non-barred than in the barred females. On the basis of full brothers, homozygous and heterozygous, respectively, for the barring gene, mated to the New Hampshire females, the same tendencies were true. Hatchability was slightly better for the heterozygous male in both cases.

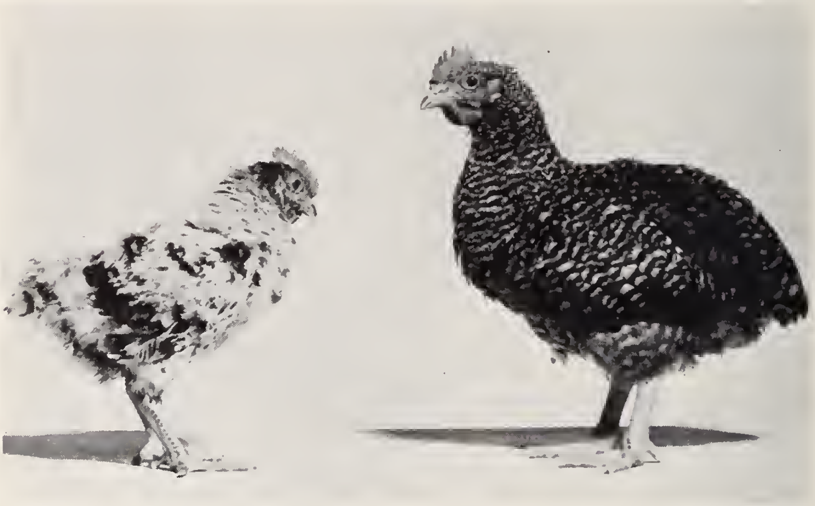

FIG. 8. *Two full brothers (Crossbreds), hatched at the same time, showing faulty pigmentation and retarded growth in bird on left due to a deficiency of folic acid in the diet.*

**Off-Colored Feathers Due to Lack of New Vitamin**—In work with New Hampshire and crossbred chicks fed special diets, it was found that poor pigmentation of feathers occurred as a result of a deficiency of a new vitamin called folic acid. Wing and body feathers of such chickens had large abnormal white and black areas unless a source of the vitamin was present in the ration. In a borderline deficiency of the vitamin, only the tips of the wing feathers were affected.

A similar condition of faulty feather pigmentation has been seen in Maryland farm poultry flocks. Work is now in progress to determine whether folic acid will prevent the condition in chickens fed practical rations.

**Distribution of Folic Acid in Common Feedstuffs Used in Poultry Rations**—It was known that chickens require this vitamin for proper growth, feather formation, and feather color development. Very little was known about the distribution of this new vitamin in common feedstuffs.

A chick assay procedure was devised which was used to measure the amount of folic acid in grains, animal by-products, and certain miscellaneous feeds. This was accomplished with the aid of a highly purified ration, complete in all nutrients except folic acid.

It was found that the common cereals (corn, oats, barley, and wheat), fishmeal, and dried milk and milk by-products are relatively poor sources of folic acid, containing less than 1 microgram per gram. Cottonseed meal, rye, wheat bran, and tankage contain 1 to 3 micrograms per gram, as measured by the chicken assay. Good sources of folic acid (3 to 15 micrograms per gram) include soybean oil meal, alfalfa leaf meal, alfalfa meal, and fermentation solubles. Dried brewer's yeast and dried liver are excellent sources of this factor.

Since many of the most commonly used feed ingredients, such as the grains and dried milk, are low in folic acid, it is likely that the level of this vitamin is critical in certain rations for chickens reared under practical conditions. Knowledge of the distribution of this vitamin is valuable, therefore, in order to properly formulate efficient poultry mashes.

**Feeding Excessive Amounts of Corn Increases Nicotinic Acid Need of Chickens**—Nicotinic acid is a vitamin of the B complex which chickens need in the ration for growth and for prevention of chick-pellagra. It was found that when large amounts of corn were fed, chickens needed more nicotinic acid in the ration than otherwise.

In an attempt to find the reason for this, various components of corn were fed to chickens receiving special diets low in nicotinic acid. When corn protein, or gelatin (similar to corn protein in that it lacks the amino acid tryptophane), was added to the ration, very poor growth was observed. Feeding the missing amino acid, tryptophane, or feeding nicotinic acid resulted in normal growth gains. Thus, the protein of corn is responsible for its action in this regard. Studies are now in progress to explain the depressing action of such tryptophane-low proteins.

It is important, therefore, when preparing formulas for poultry rations, to make certain that ample nicotinic acid is present in the ration if large amounts of corn, corn products, or other materials containing tryptophane-low proteins are included. Ordinary amounts of corn will not give any trouble in this respect.

**Slipped Tendon Due to a Number of Causes**—Slipped tendon, or perosis, is a common abnormality in chickens in which one, or both, of the legs becomes crippled at the hock joint. It is known that a deficiency of any one of several nutrients, such as manganese, choline, biotin, folic acid, or nicotinic acid, may result in this disorder. Excessive amounts of calcium and phosphorous in the ration may also cause this trouble.

It was found that feeding high levels (0.5 percent) of a thyroid-depressing drug, thiouracil, also caused slipped tendon even when ample amounts of all necessary vitamins were present. This suggests that the thyroid gland is normally involved in prevention of this disorder.

**Turkeys Need Nicotinic Acid in the Diet**—Turkey poults, when fed a highly purified ration low in nicotinic acid, grew poorly and developed certain deficiency signs, such as reddening of the mouth, diarrhea, low feed consumption, poor feathering, and a high rate of slipped tendon. Death occurred as a result of a severe deficiency of this vitamin. Higher amounts of nicotinic acid were required for normal growth (3 to 5 milligrams per 100 grams of ration) than were required by chickens. This is the first report from any laboratory of a nicotinic acid deficiency in poults.

Ordinary farm rations probably contain ample nicotinic acid unless very large amounts of corn or corn products are fed, which would increase the nicotinic acid need. Nicotinic acid is abundant in most feedstuffs with the exception of corn.

**New Hampshire Feathers Become Partially Black in Vitamin D Deficiency**—An intense black pigment was formed at the base of wing and body feathers in New Hampshire chicks fed diets low in vitamin D, the "sunshine vitamin", due to lack of this vitamin. Feathers of control birds, fed vitamin D, did not have this black color. It is believed that the blackening is due to faulty metabolism of the thyroid gland.

This finding may be used as a diagnostic aid in the determination of vitamin D deficiency in New Hampshire or Rhode Island Red chickens in farm flocks. A deficiency of calcium in the diet resulted in a similar condition; however, the blackening was not as intense.

**Use of Curbay B-G in Poultry Rations**—Studies on Curbay B-G (fermentation solubles produced by U. S. Industrial Chemicals, Inc., Baltimore) as a source of riboflavin for poultry were continued. It was found that New Hampshire chickens utilized the riboflavin in Curbay B-G to the same extent as pure synthetic riboflavin. An advantage of Curbay B-G over synthetic riboflavin was found in that it gave considerably better growth than riboflavin alone when added to certain practical rations, due to the presence of other nutrients in the Curbay B-G. Also, results with different levels of Curbay B-G were more consistent than with equal levels of riboflavin. This was probably due to the difficulty of mixing very small amounts of riboflavin in practical rations. These studies are being continued.

**"Synthetic" Ration for Chickens for Laboratory Use**—A successful "synthetic" ration, containing none of the usual grains or other feedstuffs found in practical poultry rations, has been developed at the University of Maryland Poultry Department for laboratory use. This ration is "synthetic" in the sense that it is specially made of many synthetic and highly purified ingredients. Each nutrient is added in pure form so that such materials as glucose, folic acid, choline, biotin, riboflavin, casein. etc., are present. A deficiency of any desired nutrient may be obtained merely by omitting it from the ration. When fed to chickens, the complete "synthetic" ration gives better growth gains than does the best of practical rations.

The "synthetic" ration is an extremely useful tool in the laboratory. Knowledge gained from its use can be applied directly to the formulation of practical mashes and to increasing the efficiency of feed utilization. Also, basic information may be obtained which can be applied to other farm animals and to humans.

It should be made clear that "synthetic" rations cannot be used on the farm at present. Their cost is much greater than ordinary farm rations. However, many practical facts can be learned from their use in the laboratory.

**Resistance to Pullorum Disease in Chickens** — Selection and progeny testing offer a possibility of developing a substantial level of inherited resistance to pullorum disease, according to results obtained. This resistance was developed in Rhode Island Reds used until it represented a level of about 4 to 1 in comparison with resistance of unselected stock. While the resistance shown to exist was always "low grade" and not "solid" immunity, its level increased until at the termination of the project 50 percent of the dams produced chicks showing 100 percent livability when subjected to standard inoculation.

When inoculated resistant chicks were chilled at 60° F. for 5 hours, their mortality rate did not differ significantly from the non-chilled inoculated chicks. This indicated that the resistance in the Maryland resistant Rhode Island Reds was specific and not associated with general vigor. Since chilling results appeared negative, the effect of low brooding temperature upon mortality of inoculated chicks was studied. The low-temperature group was brooded without supplementary heat at room temperature of 85.55° F. Inoculated chicks brooded at room temperature showed 69.4 percent mortality in 22 days, compared with a mortality of 37.1 percent when chicks were brooded in hovers heated to a temperature averaging 93° F.

This work revealed an additional control measure for pullorum disease, upon a closed flock basis, and confirmed the existence of susceptibility in chicks from pullorum-free flocks of long standing, thus bringing scientific confirmation of the importance of maintaining blood testing programs and a high level of incubator sanitation.

# PUBLICATIONS

## BULLETINS

| Number | Title | Authors |
|---|---|---|
| A 38 (Tech) | An Annotated List of the Spiders. | M. H. Muma |
| A 39 | Chemical & Nutritional Studies of Canned Vegetable Soybeans | A. Kramer<br>C. H. Mahoney<br>Elizabeth Stephenson<br>Agnes Marks |
| A 40 | Postwar Purchase and Improvement Plans of Farmers. | A. M. Ahalt<br>S. H. DeVault<br>L. E. Flesch |
| A 41 | Postwar State and Local Revenues in Relation to Rural Public Services in Maryland | W. P. Walker<br>S. H. DeVault |
| A 42 | Practical Technique for Classifying Farm Land for Tax Purposes. | W. P. Walker |

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| A 102 | The Nutritive Value of Canned Foods IX. Proximate & Mineral Composition. | A.Kramer |
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| A 104 | Observations on an Unidentified Feather-Pigment Factor Necessary for Chickens Fed Purified Diets. *Poultry Science.* | G. M. Briggs |
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| A 107 | The Biology, Nutrition & Control of the Allegheny Mound Ant, *FORMICA EXSECTOIDES.* | Elizabeth E. Haviland |
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| A 121 | Live and Dressed Grades in Relation to Body Measurements in Twelve-Week Old Purebred and Crossbred Chickens. *Poultry Science.* | C. O. Frischknecht<br>M. A. Jull |
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| A 129 | Rate of Feathering and Ten-Week Body Weight Observations in Strains Differing in Shank Length. *Poultry Science.* | E. W. Glazener<br>M. A. Jull |
| A 130 | The Relation of Water Available and Auxin in the Growth of *Avena* Coleoptiles and its Meaning for a Theory of Tropisms. *American Journal of Botany.* | H. G. DuBuy<br>Jane Showacre |
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| A 132 | Effect of Thiouracil on the Juvenile Plumages of Brown Leghorn Fowl. *Endocrinology.* | Mary Juhn |
| A 133 | Effect of Thiouracil on Naturally Occuring Molt in the Hen. *Poultry Science.* | E. W. Glazener<br>M. A. Jull |

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| Number | Title | Authors |
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| 39 | Farm Production Adjustments for 1946 in Maryland. (Mimeographed Circular.) | S. H. DeVault<br>A. B. Hamilton |
| 40 | The Use of an Antioxidant in Preventing Hydrolytic Rancidity in Dairy Products. | I. A. Gould |
| 41 | Self Propelled Aerosol Sprays for Control of the Pea Aphid. (Pennsylvania Growers Association.) | L. P. Ditman<br>G. J. Burkhardt |
| 42 | Some Helpful Suggestions on Growing Gladioli. (1945 Gladioli Year Book.) | R. Bamford<br>C. E. Cox |
| 43 | Performance of Hybrid Corn in 1945. (Planographed Circular.) | R. G. Rothgeb |
| 44 | The Agronomic Use of Power Machinery. (Proceedings of the Soil Science of America.) | R. P. Thomas |
| 46 | Naming Soil Series. (1945 Proceedings of the Soil Science of America.) | R. P. Thomas |
| 47 | Sweet Corn Field Trials in 1945. (Mimeographed Circular.) | R. G. Rothgeb |
| 48 | Forty Seven Years of Pea Aphid Control. (Food Packer.) | L. P. Ditman |
| 49 | Di-Ammonium Phosphate as a Protein Supplement for Ruminants. | J. C. Shaw<br>C. D. Caskey<br>G. M. Cairns |

## CURRENT PROJECTS

### AGRICULTURAL ECONOMICS

A-18. ORGANIZATION, OPERATION AND BUSINESS ANALYSIS OF MARYLAND FARMS.

- A-18-u. Farm Management Adjustments and Factors Encountered by Farmers in Attaining Increased Production in the Wartime Program.
- A-18-v. Post-War Needs of Farmers in Maryland.
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- A-19-d. Problems in Farm Income Tax Reporting and Record Keeping.
- A-19-e. Changes Needed in the Maryland Tax System by Virtue of Wartime and Post-War Governmental Finance.
- A-19-f. Practical Technique for Detailed Classification of Farm Land for Property Tax Purposes.
- A-19-g. Forest Taxation in Maryland. (New).
- A-26-j. The Effect of Changes in Transportation on Marketing Systems for Maryland Farm Products.
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### AGRICULTURAL ENGINEERING

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R-6. Investigations of Grain Storage on the Farm.

R-9. Sweet Potato Curing and Storing.

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B-41. Barley—Hybridization for Smooth Awns.

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O-47. The Available Supplies and Relative Agricultural Values of By-Product Liming Materials of Eastern Maryland.

—— Production of Grain Sorghums.

—— Tobacco Investigations. (Coop. with USDA.)

—— The Improvement, Production and Use of Rye in Maryland. (Coop. with Maryland Distillers.)

### AGRONOMY—SEED INSPECTION

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N-8. Examination of Samples from Seeds Sold Throughout the State.

N-9. Examination of Samples Submitted to the Laboratory.

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J-80. DISEASES OF TRUCK AND CANNING CROPS.
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M-36-f. Response in Feathering in Hybrid and Purebred Fowl Fed Selenium as a Check on Feather-Pigment Reactions Due to Leucosis.

M-36-g. Effect of Long-Time Thiouracil Treatment on Feather Pigmentation in Brown Leghorns and Other Breeds and Hybrids as a Further Check on Feather-Pigment Reaction Due to Leucosis.

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M-43. EFFECT OF HORMONES ON PLUMAGE, GROWTH, FATTENING AND OTHER CHARACTERISTICS IN POULTRY.

M-43-a. Relations of Thymus to Induced Molt.

M-43-b. Determining Feather Genotype Through Hormone Effects in Lieu of Breeding.

M-43-c. Effect of Thiouracil and Other Hormones on Growth in Chickens.

## CHANGES IN PERSONNEL

**Appointments:**

G. M. Cairns, Professor and Head, Dairy Husbandry, August 16, 1945.
Frances L. Cron, Assistant in Agricultural Economics, November 12, 1945.
Catherine T. Dellea, Instructor in Dairying, December 10, 1945.
A. C. Groschke, Assistant in Poultry Husbandry, February 1, 1946.
R. G. Hill, Assistant in Horticulture, April 1, 1946.
P. B. Larsen, Assistant Professor Dairy Husbandry, March 1, 1946.
R. J. Lillie, Assistant in Poultry Husbandry, September 1, 1945.
M. G. McCartney, Assistant in Poultry Husbandry, February 1, 1946.
R. D. Rappleye, Assistant, Botany, October 15, 1945.
J. C. Shaw, Professor Dairy Husbandry, December 1, 1945.
C. C. Stepanek, Assistant in Horticulture, April 1, 1946.
R. N. Stewart, Assistant in Botany, October 1, 1945.
R. E. Stout, Assistant Inspector Dairy Husbandry, February 18, 1946.

**Resignations:**

M. H. Berry, Associate Professor, Dairy Husbandry, February 28, 1946.
Frances L. Cron, Assistant in Agricultural Economics, June 30, 1946.
E. W. Glazener, Assistant Professor, Poultry Husbandry, June 30, 1946.
E. H. Grater, Instructor in Horticulture, September 25, 1945.
F. J. Gregarek, Assistant Professor Dairy Manufacturing, March 1, 1946.
A. C. Groschke, Assistant in Poultry, March 4, 1946.
J. E. Hawes, Assistant in Horticulture, February 1, 1946.
C. W. Hitz, Assistant Pomologist, June 30, 1946.
H. A. Hunter, Associate Professor Canning Crops, August 15, 1945.
R. E. Jones, Instructor in Botany, June 30, 1946.
C. H. Mahoney, Professor and Head, Horticulture, April 15, 1946.
I. D. Porterfield, Instructor in Dairy Husbandry, May 23, 1946.
K. C. Reynolds, Assistant in Soils, May 15, 1946.
Frank Taylor, Assistant in Dairy Husbandry, October 1, 1945.
E. S. Troelston, Associate Professor, Agricultural Economics, June 30, 1946.
Amanda Ulm, Assistant in Botany, July 31, 1945.
Miye Yamasaki, Assistant in Soils, May 15, 1946.

## FINANCIAL STATEMENT - JULY 1, 1945 TO JUNE 30, 1946

| | FEDERAL FUNDS | | | | |
|---|---|---|---|---|---|
| | Hatch | Adams | Purnell | Bankhead-Jones | |
| Balance June 30, 1945 | .... | .... | .... | $ .03 | |
| Appropriations for 1945-46 | $15,000. | $15,000. | $60,000. | 32,781.37 | |
| Totals | $15,000. | $15,000. | $60,000. | $32,781.40 | |
| **Receipts from sources other than Federal 1945-46** | | | | | **For Agr. Investigations*** |
| State appropriations for agricultural investigations | | | | | $105,029.00 |
| Industrial Grants | | | | | 23,075.10 |
| Sales and Miscellaneous | | | | | 65,492.14 |
| | | | | | $193,596.24 |
| Balance brought forward July 1, 1945 | | | | | 38,988.87 |
| Total | | | | | $232,585.11 |
| **Expenditures:-** | | | | | |
| Personal Services | $11,536.47 | $12,769.98 | $45,664.96 | $22,343.73 | $ 92,239.42 |
| Travel | 75.00 | 671.27 | 1,958.78 | 1,067.55 | 3,075.86 |
| Transportation | 2.00 | 6.88 | 18.84 | 21.00 | 727.37 |
| Communication Service | .... | .... | 16.00 | .... | 1,166.77 |
| Rents and Utility Services | .... | .... | .... | 134.43 | 1,867.98 |
| Printing and Binding | .... | 12.43 | 557.97 | 73.50 | 851.00 |
| Other Contractual Services | .... | 121.19 | 588.54 | 308.35 | 8,372.86 |
| Supplies and Materials | 3,032.35 | 1,325.74 | 9,873.80 | 8,358.68 | 49,499.25 |
| Equipment | 354.18 | 92.51 | 1,294.48 | 474.16 | 18,405.76 |
| Land and Structures | .... | .... | .... | .... | .... |
| Contributions to Retirement | .... | .... | .... | .... | .... |
| | $15,000.00 | $15,000.00 | $59,973.37 | $32,781.40 | $176,206.27 |
| | .... | .... | 26.63 | .... | 56,378.84 |
| | $15,000.00 | $15,000.00 | $60,000.00 | $32,781.40 | $232,585.11 |

*Including Bankhead-Jones Offset Funds.

D

[illegible]

DO NOT CIRCULATE

DO [redacted] CIRCULATE